ABSTRACT

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A COMPARISON OF BOVINE SERUM ALBUMIN ADSORPTION ON SELF-ASSEMBLED MONOLAYERS AND GOLD USING A QUARTZ CRYSTAL MICROBALANCE, Scott B. Thourson[1], Bryan J. Doyle[2], Shannon J. Timpe[1]*, Bradley University[1], Department of Mechanical Engineering, Peoria, IL 61625, Alma College[2], Departments of Biology and Biochemistry, Alma, MI 48801, sjtimpe@bumail.bradley.edu

Optimizing methods for protein immobilization on surfaces is essential for development of efficient biosensors and effective biocompatible materials. Self-assembled monolayer (SAM) functionalization is one technique to control the properties of protein immobilization on sensor surfaces. In the current work protein immobilization onto functionalized and nonfunctionalized gold surfaces was examined using the model protein bovine serum albumin (BSA). A quartz crystal microbalance (QCM) was used for *in situ* detection of protein adsorption. Fundamental dynamic resonance modeling was used to relate changes in natural frequency to changes in mass as adsorption occurs at the surface of the oscillating crystal. BSA adsorption was measured as a function of protein concentration on unmodified crystals and crystals functionalized with a SAM of 12-mercaptododecanoic acid NHS ester. For all tested BSA concentrations, adsorption saturated at approximately 450 ng/cm^2 regardless of whether the surface was functionalized or not. 8-Anilino-1-naphthalenesulfonic (ANS), a molecule known to bind to BSA, was then used to examine the binding characteristics of the protein-coated surfaces. A fixed concentration of ANS solution was introduced to both SAM-functionalized and non-functionalized crystals with immobilized BSA. Similar binding capacities and adsorption rates were found for ANS onto SAM-functionalized and nonfunctionalized crystals. However, the adsorption rate of ANS onto BSA was observed to depend on the BSA concentration used in the previous step to saturate the surface. Lower concentration of BSA resulted in a decreased rate of ANS adsorption. It is hypothesized that the binding of BSA in a high concentration environment leads to a preferentially oriented BSA with regards to ANS binding, which may be explained by a diffusion limited behavior at lower concentrations as compared to a reaction limited behavior at higher concentrations. Results are interpreted in light of the principle protein adsorption mechanisms, conformational changes, and the implications for custom biosensor development. With regards to the primary objective of this investigation, the results support the conclusion that the functionalization of gold surfaces with NHS-terminated SAMs has little effect on the adsorption of BSA.

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